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Cost-effective, Smart Grid-enabled, Utility-scale Distributed Energy Storage

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ICE ENERGY

Intelligent Distributed Energy Storage.



Overview

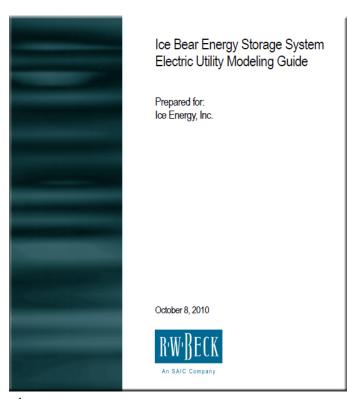
- ➤ Intelligent Distributed Energy Storage is:
 - Proven
 - > Reliable
 - Cost effective
 - Smart Grid enabled
 - Available for large scale deployment
- Intelligent Distributed Energy Storage Benefits:
 - Reduction of summer peak demand
 - Better integration of renewables,
 - Deferral or avoidance of peaking plants, T&D
 - Reduction of carbon and NOx
 - Creation of hundreds of local California jobs

Proven Technology – Commercially Available

- More than 5 million hours of field collected data
- > Successful pilots by 24 utilities over a seven-year period
- > Advanced manufacturing plant in Hammondsport, New York
- Existing 53 Megawatt Utility Scale Contract with SCPPA
- Industry OEM Partnerships:
 - OSIsoft PI enterprise infrastructure
 - AT&T wireless 3G network services
 - Trane "Ice Ready" high efficiency rooftop units
 - Carrier "Ice Ready" high efficiency rooftop units

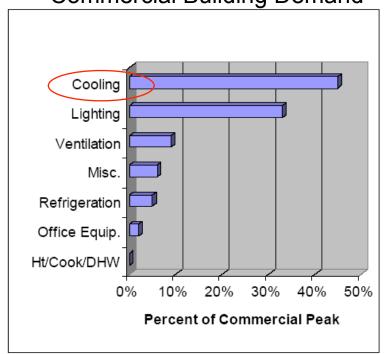
Benefits of Distributed Energy Storage

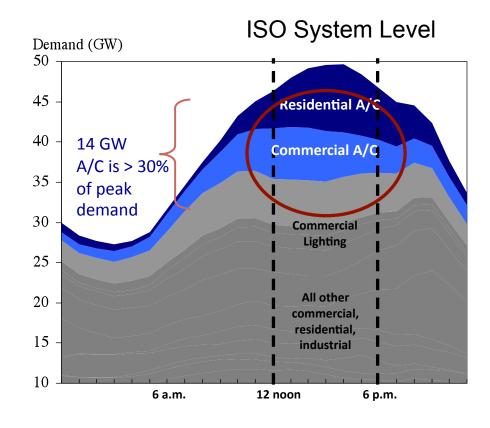
- Improved system efficiency
- Avoided or delayed simple cycle peakers
- Avoided or delayed T&D system expenses
- Reduction in reactive power requirements
- Increased system power transfer capability
- Improved daily electric system load profile
- Avoided electric system losses
- Enhanced integration of renewable resources
- Improved system power factor & voltage support
- Eliminates fault-induced delayed voltage recovery (AC stalling)



California Peak Demand Problem: AC Load

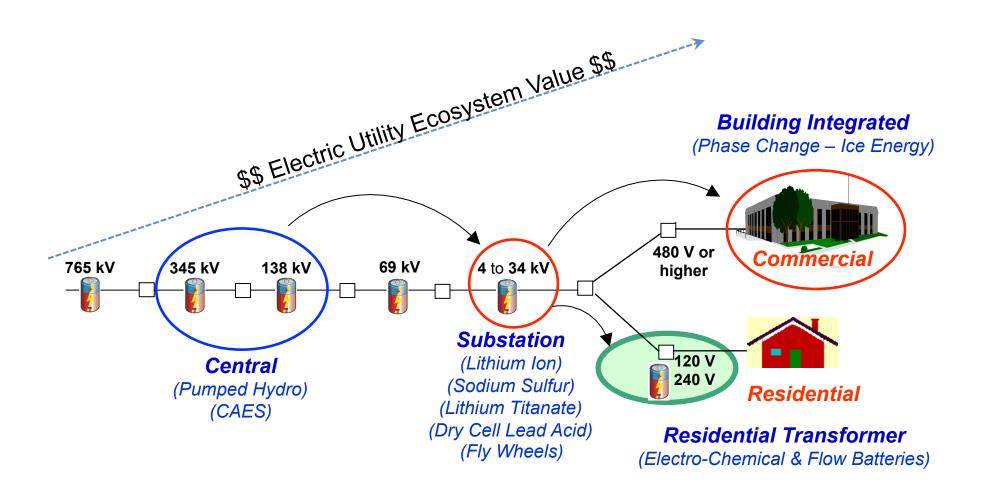






- Calif. addressable market exceeds 5,000 MW
- Cooling is becoming about ½ the commercial load
- Commercial A/C load extends beyond the utility peak period

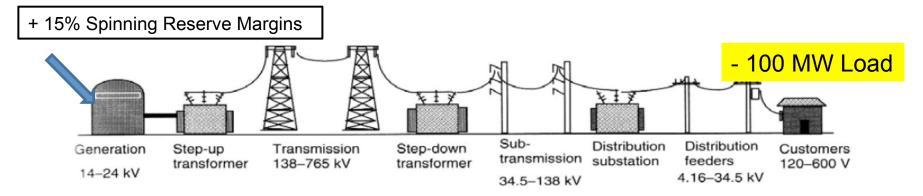
Value of Energy Storage Increases as it Approaches the Edge of the Grid



Energy Loss is Greatest During Hottest Periods

Summer Peak Scenario

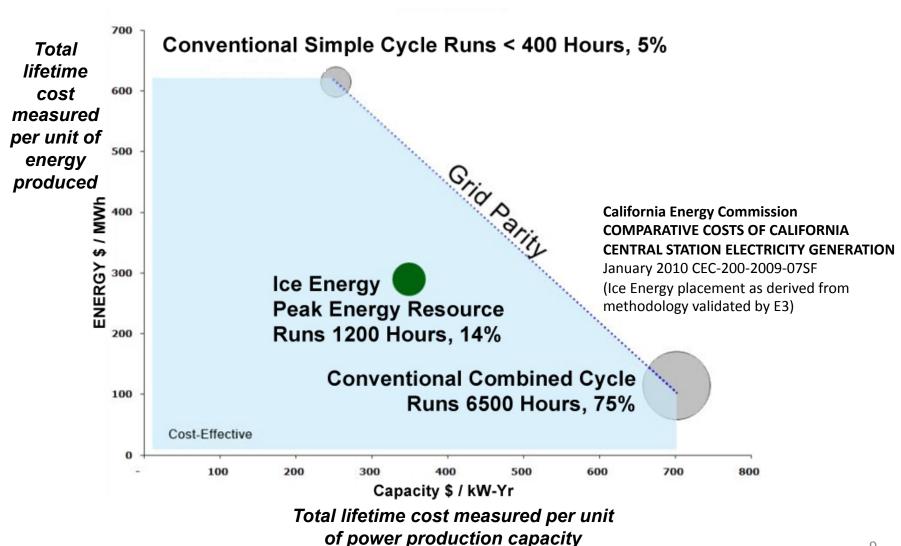
148 MW Generator Nameplate Capacity & Spinning Reserves



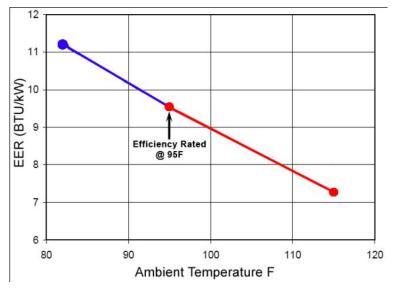
Source-Equivalent Multipliers, by City

| Source Equivalents | | Offset peak | Reserve | Source- |
|--------------------|------------|-------------|------------|------------|
| | Grid loss | generation | margin | Equivalent |
| City | adjustment | adjustment | adjustment | Multiplier |
| Albuquerque, NM | 112.0% | 145.2% | 115.0% | 187% |
| Atlanta, GA | 111.2% | 121.8% | 115.0% | 156% |
| Chicago, IL | 111.2% | 118.7% | 115.0% | 152% |
| Denver, CO | 111.8% | 142.9% | 117.0% | 187% |
| Fresno, CA | 111.3% | 123.5% | 115.3% | 158% |
| Houston, TX | 111.7% | 118.7% | 114.0% | 151% |
| Los Angeles, CA | 111.5% | 114.3% | 116.0% | 148% |
| Miami, FL | 111.4% | 114.8% | 120.0% | 153% |
| New York, NY | 112.1% | 116.6% | 116.5% | 152% |
| Phoenix, AZ | 113.5% | 131.7% | 115.0% | 172% |
| St. Louis, MO | 111.9% | 120.2% | 114.0% | 153% |
| Washington, DC | 112.5% | 118.3% | 115.5% | 154% |

Cost Effective Today Without Subsidy

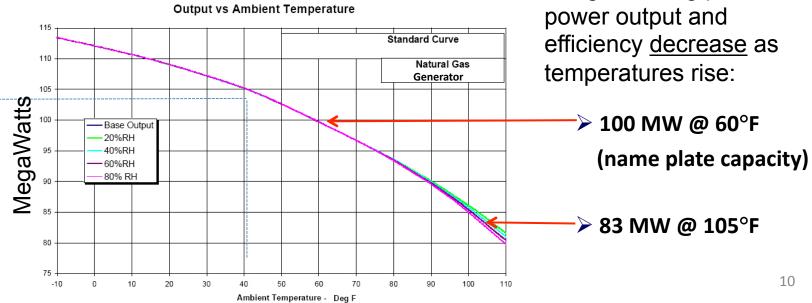


Energy Efficiency of Traditional Compressors and Peaker Plants Decrease with Heat



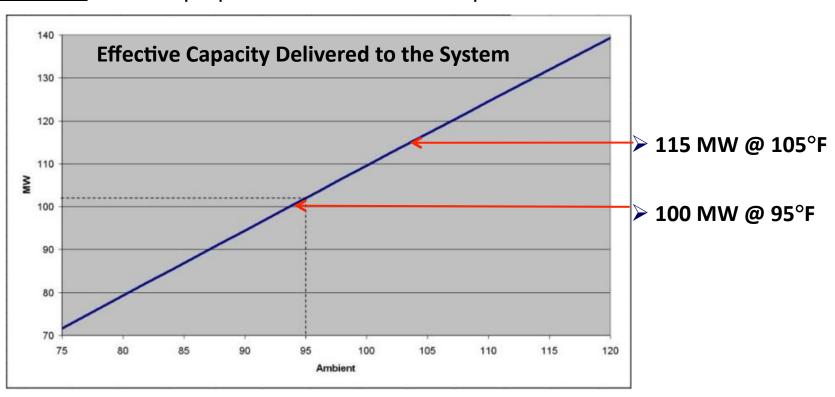
HVAC Compressor energy efficiency <u>decreases</u> as temperatures rise; thus energy demand <u>increases</u> to maintain cooling and comfort.

For generating plants,



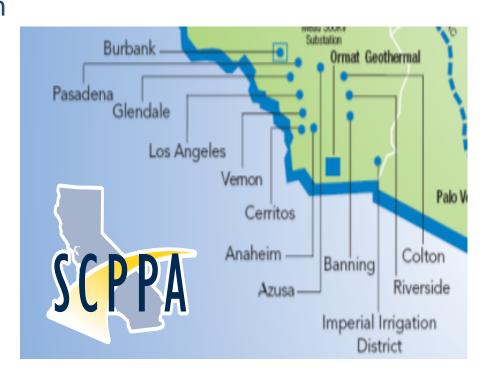
System Capacity Effect of Ice Bear Deployments

- ➤ The efficiency of the electrical system generation, transmission, distribution and mechanical systems <u>degrades</u> as temperatures rise.
- ➤ Therefore, the value of thermal storage to the electrical system increases in direct proportion to the rise in temperature



Southern California Public Power Authority

- Joint powers authority with 11 municipal utilities and 1 irrigation district in So Cal
- \$4.4 billion in annual revenues
- 8,800 megawatt peak demand
- Delivers electricity to ~2 million customers over 7,000 square miles



Applicable to Nearly All Building Types



Customer Acquisition & Commissioning Mature, High Quality, & Turnkey







Box Retailer



Fast Food



Ice Ready Rooftop Units Directly from Trane & Carrier Factory



11 Units Federal Building New Construction w/Solar PV

Ice Energy is More Than Just the Ice Bear



Distributed resources

Real-time control

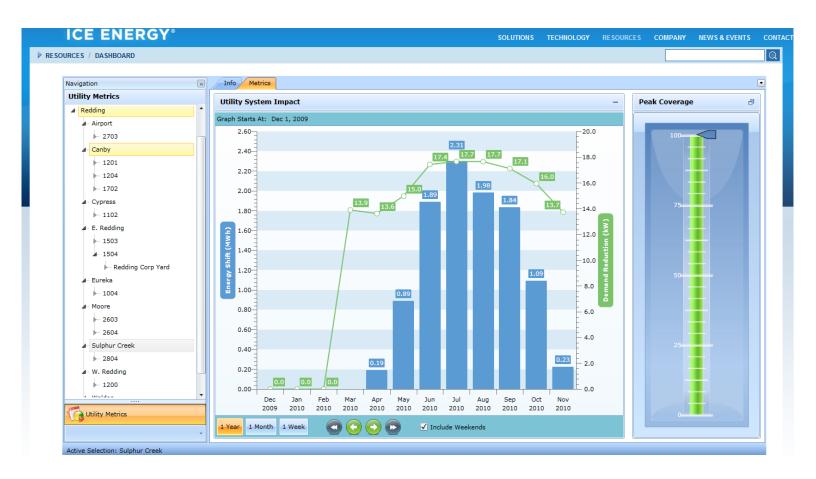
Aggregated units managed as a single resource.



CoolData Smart Grid Architecture:

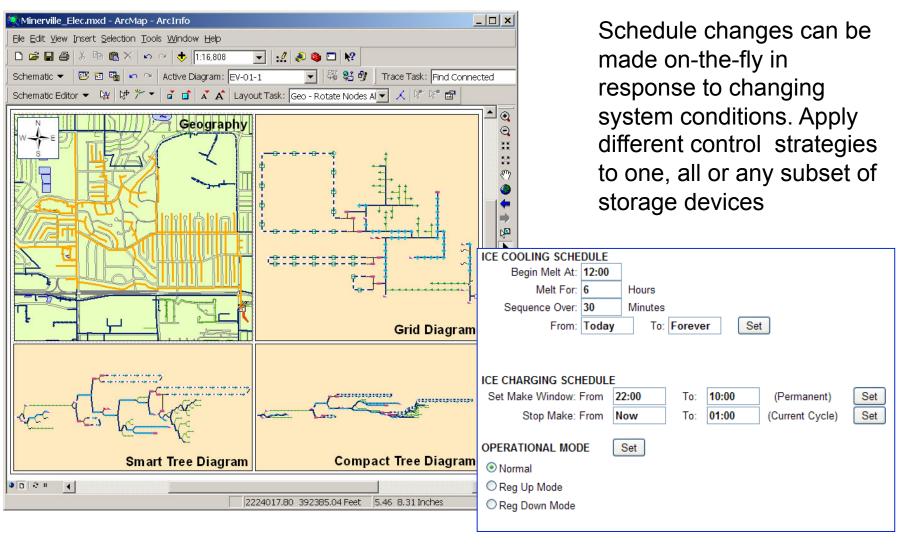
- Reliable
- Scalable
 - Supports 30,000 On-line Users
 - Supports 100 GigaWatts of distributed resource

Utility-Configurable Dashboard



- >Provides control, measurement, verification, and custom-defined reporting
- ➤ Organize and summarize results as needed with flexible navigation pane.
- > Organized by Area, Substation, Feeder, and Building.

Resource Ties Directly into Utility Operations Providing Dispatch & Control



Recent Highlights

- CSI Grant SUN + ICE, SunPower, Target, Ice Energy, **KEMA**, Sandia Labs
- Redding Electric Utility Social Security Building, New Construction 12 Trane units
- Glendale Upgraded and replaced most city owned HVAC units + Ice
- FirstEnergy EPRI Smart Grid Project with Staples in Howell, NJ
- Ontario Power Authority Large Demo Grant with Toronto-Hydro and Veridian



Paul Hauser Director of REU



Ice Bear and Trane Ice Ready RTU's

Distributed Energy Distributed Job Creation

High Local Content

A 100 Megawatt project will generate roughly 300 direct jobs paying hourly wages of \$60 million associated with the building of units, installation, and commissioning.

Field Crews: Electricians, Crane Operators, Instrument Technicians, HVAC Technicians, Landscapers, Roofers, Truck Drivers

Manufacturing: Supervisors, Materials Handling, Quality Control, Administration, Warehouse Logistics, Factory Manager, Assemblers, Operators, Technicians

Business: Legal/Accounting, Application Support, Permitting, Mechanical Design Engineer, Electrical Design Engineer, Inside Sales Support, Call Center, Outside Sales, Materials Manager, Customer Marketing

Economic Development Impact - Multiplier Effect: 4x - 7x

These jobs can – and should be – in California!

Barriers to Adoption of Cost-effective Intelligent Distributed Energy Storage

- Inadequate familiarity with storage's recent <u>technological</u> <u>progress</u> and <u>extensive benefits</u>
- ➤ Lack of generally agreed upon <u>cost-effectiveness methodology</u>
- Insufficient recognition of system-wide energy/cost inefficiencies during peak
- Regulatory regimes do not yet fully consider storage
- Incomplete internalization of numerous <u>environmental and other</u> <u>externalities</u>
- Challenges of optimally and cheaply <u>integrating renewables</u> only now being fully recognized

Summary

- > Proven, Reliable, Cost Effective, Commercially Available, Long Asset Life
- Distributed Energy Storage delivers the greatest value to the utility ecosystem
- Aggregated Distributed Energy Storage is MW and GWh scale
- Utilities and entire grid can satisfy multiple goals with one measure
 - > Save ratepayer \$\$, shift energy consumption to off-peak rates
 - Reduce peak demand
 - Increase existing asset utilization
 - Replace old less efficient HVAC units
 - Integrate energy only renewables, SUN + ICE
 - > Defer and avoid building unneeded peaking facilities
 - Improve distribution circuit reliability
 - Reduce carbon and smog
 - Create living wage local jobs
- We request that Distributed Energy Storage be included by the Energy Commission in the IEPR and other relevant policy proceedings as a valuable, utility-scale, cost effective, renewables-integrating, commercially available resource.